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L36	l13 aned l32	4902	L36
L35	l11 aned l32	4908	L35
L34	l4 aned l32	5071	L34
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L32	705/36	1448	L32
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L12	L11 and long and short with put same option	8	L12
L11	L4 and (risk-return with value or risk with return with value or risk-value near return or risk adj value adj return)	49	L11
L10	L4 and l6 not l5	0	L10
L9	L8 and long and short with put same option	8	L9
L8	L7 and call with option	22	L8
L7	L5 and (risk-return with value or risk with return with value or risk-value near return or risk adj value adj return)	43	L7
L6	L5 and risk-return with value	2	L6
L5	L4 and investor	153	L5
L4	derivative near securities	256	L4
L3	705.clas.	42672	L3
L2	705/1	5896	L2
L1	705/37	2508	L1

END OF SEARCH HISTORY

Patent Assignment Abstract of Title

Total Assignments: 2

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Inventors: Patrick Man Ning Wong, James Yip, Siu Leung Li

Title: Customized derivative securities

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Reel/Frame:	Received:	Recorded:	Mailed:	Pages:
013651 / 0334	01/15/2003	01/13/2003	05/14/2003	4

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors: NING, PATRICK WONG MAN **Exec Dt:** 12/18/2002
YIP, JAMES **Exec Dt:** 12/18/2002
LEUNG, LI SIU **Exec Dt:** 12/18/2002

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Assignment: 2

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Conveyance: CORRECTIVE TO CORRECT THE APPLICATION NUMBER PREVIOUSLY RECORDED AT REEL 013651 FRAME 0334. (ASSIGNMENT OF ASSIGNOR'S INTEREST)

Assignors: NING, PATRICK WONG MAN **Exec Dt:** 12/18/2002
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Search Results as of: 6/7/2006 7:16:44 A.M.

L9: Entry 8 of 8 File: PGPB Jul 25, 2002

DOCUMENT-IDENTIFIER: US 20020099640 A1
TITLE: Digital options having demand-based, adjustable returns, and trading exchange therefor

Summary of Invention Paragraph:
[0005] Online trading firms such as E-Trade Group, Charles Schwab, and Ameritrade have all experienced significant growth in revenues due to increases in online trading activity. These companies currently offer Internet-based stock trading services, which provide greater convenience and lower commission rates for many retail investors, compared to traditional securities brokerage services. Many expect online trading to expand to financial products other than equities, such as bonds, foreign exchange, and financial instrument derivatives.

Summary of Invention Paragraph:
[0006] Financial products such as stocks, bonds, foreign exchange contracts, exchange traded futures and options, as well as contractual assets or liabilities such as reinsurance contracts or interest-rate swaps, all involve some measure of risk. The risks inherent in such products are a function of many factors, including the uncertainty of events, such as the Federal Reserve's determination to increase the discount rate, a sudden increase in commodity prices, the change in value of an underlying index such as the Dow Jones Industrial Average, or an overall increase in investor risk aversion. In order to better analyze the nature of such risks, financial economists often treat the real-world financial products as if they were combinations of simpler, hypothetical financial products. These hypothetical financial products typically are designed to pay one unit of currency, say one dollar, to the trader or investor if a particular outcome among a set of possible outcomes occurs. Possible outcomes may be said to fall within "states," which are typically constructed from a distribution of possible outcomes (e.g., the magnitude of the change in the Federal Reserve discount rate) owing to some real-world event (e.g., a decision of the Federal Reserve regarding the discount rate). In such hypothetical financial products, a set of states is typically chosen so that the states are mutually exclusive and the set collectively covers or exhausts all possible outcomes for the event. This arrangement entails that, by design, exactly one state always occurs based on the event outcome.

Summary of Invention Paragraph:
[0013] The return to a trader of a traditional derivative product is, in most cases, largely determined by the value of the underlying security, asset, liability or claim on which the derivative is based. For example, the value of a call option on a stock, which gives the holder the right to buy the stock at some future date at a fixed strike price, varies directly with the price of the underlying stock. In the case of non-financial derivatives such as reinsurance contracts, the value of the reinsurance contract is affected by the loss experience on the underlying portfolio of insured claims. The prices of traditional derivative products are usually determined by supply and demand for the derivative based on the value of the underlying security (which is itself usually determined by supply and demand, or, as in the case of insurance, by events insured by the insurance or reinsurance contract).

Summary of Invention Paragraph:
[0014] Currently, the costs of trading derivative securities (both on and off the exchanges) and transferring insurance risk are considered to be high for a number of reasons, including:

Summary of Invention Paragraph:
[0020] Derivatives traders typically hedge their exposures throughout the life of the derivatives contract. Effective hedging usually requires that an active or liquid market exist, throughout the life of the derivative contract, for both the underlying security and the derivative. Frequently, especially in periods of financial market shocks and disequilibria, liquid markets do not exist to support a well-functioning derivatives market.

Summary of Invention Paragraph:
[0022] Dynamic hedging of derivatives often requires continual transactions in the market over the life of the derivative in order to reduce, eliminate, and manage risk for a derivative or portfolio of derivative securities. This usually means paying bid-offers spreads for each hedging transaction, which can add significantly to the price of the derivative security at inception compared to its theoretical price in absence of the need to pay for such spreads and similar transaction costs.

Summary of Invention Paragraph:
[0032] Traditional capital and insurance markets are often viewed as incomplete in the sense that the span of contingent claims is limited, i.e., the markets may not provide opportunities to hedge all of the risks for which hedging opportunities are sought. As a consequence, participants typically either bear risk inefficiently or use less than optimal means to transfer or hedge against risk. For example, the demand by some investors to hedge inflation risk has resulted in the issuance by some governments of inflation-linked bonds which have coupons and principal amounts linked to Consumer Price Index (CPI) levels. This provides a degree of insurance against inflation risk. However, holders of such bonds frequently make assumptions as to the future relationship between real and nominal interest rates. An imperfect correlation between the contingent claim (in this case, inflation-linked bond) and the contingent event (inflation) gives rise to what traders call "basis risk," which is risk that, in today's markets, cannot be perfectly insured or hedged.

Summary of Invention Paragraph:
[0036] Patents relating to derivatives, such as U.S. Pat. No. 4,903,201, disclose an electronic adaptation of current open-outcry or order matching exchanges for the trading of futures is disclosed. Another recent patent, U.S. Pat. No. 5,806,048, relates to the creation of open-end mutual fund derivative securities to provide enhanced liquidity and improved availability of information affecting pricing. This patent, however, does not contemplate an electronic derivatives exchange which requires the traditional hedging or replicating portfolio approach to synthesizing the financial derivatives. Similarly, U.S. Pat. No. 5,794,207 proposes an electronic means of matching buyers' bids and sellers' offers, without explaining the nature of the economic price equilibria achieved through such a market process.

Summary of Invention Paragraph:
[0037] The present invention is directed to systems and methods of trading, and financial products, having a goal of reducing transaction costs for market participants who hedge against or otherwise make investments in contingent claims relating to events of economic significance. The claims are contingent in that their payout or return depends on the outcome of an observable event with more than one possible outcome. An example of such a contingent claim is a digital option, such as a digital call option, where the investor receives a payout if the underlying asset, stock or index expires at or above a specified strike price and

receives no payout if the underlying asset, stock or other index expires below the strike price. The contingent claims relate to events of economic significance in that an investor or trader in a contingent claim typically is not economically indifferent to the outcome of the event, even if the investor or trader has not invested in or traded a contingent claim relating to the event.

Summary of Invention Paragraph:
[0038] Intended users of preferred and other embodiments are typically institutional investors, such as financial institutions including banks, investment banks, primary insurers and reinsurers, and corporate treasurers. Users can also include any individual or entity with a need for risk allocation services. As used in this specification, the terms "user," "trader" and "investor" are used interchangeably to mean any institution, individual or entity that desires to trade or invest in contingent claims or other financial products described in this specification.

Summary of Invention Paragraph:
[0041] As used in this specification, the term "contingent claim" shall have the meaning customarily ascribed to it in the securities, trading, insurance and economics communities. "Contingent claims" thus include, for example, stocks, bonds and other such securities, derivative securities, insurance contracts and reinsurance agreements, and any other financial products, instruments, contracts, assets, or liabilities whose value depends upon or reflects economic risk due to the occurrence of future, real-world events. These events may be financial-related events, such as changes in interest rates, or non-financial-related events such as changes in weather conditions, demand for electricity, and fluctuations in real estate prices. Contingent claims also include all economic or financial interests, whether already traded or not yet traded, which have or reflect inherent risk or uncertainty due to the occurrence of future real-world events. Examples of contingent claims of economic or financial interest which are not yet traded on traditional markets are financial products having values that vary with the fluctuations in corporate earnings or changes in real estate values and rentals. The term "contingent claim" as used in this specification encompasses both hypothetical financial products of the Arrow-Debreu variety, as well as any risky asset, contract or product which can be expressed as a combination or portfolio of the hypothetical financial products.

Summary of Invention Paragraph:
[0042] For the purposes of this specification, an "investment" in or "trade" of a contingent claim is the act of putting an amount (in the units of value defined by the contingent claim) at risk, with a financial return depending on the outcome of an event of economic significance underlying the group of contingent claims pertaining to that event.

Summary of Invention Paragraph:
[0043] "Derivative security" (used interchangeably with "derivative") also has a meaning customarily ascribed to it in the securities, trading, insurance and economics communities. This includes a security or contract whose value depends on such factors as the value of an underlying security, index, asset or liability, or on a feature of such an underlying security, such as interest rates or convertibility into some other security. A derivative security is one example of a contingent claim as defined above. Financial futures on stock indices such as the S&P 500 or options to buy and sell such futures contracts are highly popular exchange-traded financial derivatives. An interest-rate swap, which is an example of an off-exchange derivative, is ar agreement between two counterparties to exchange series of cashflows based on underlying factors, such as the London Interbank Offered Rate (LIBOR) quoted daily in London for a large number of foreign currencies. Like the exchange-traded futures and options, off-exchange agreements can fluctuate in value with the underlying factors to which they are linked or derived. Derivatives may also be traded on commodities, insurance events, and other

events, such as the weather.

Summary of Invention Paragraph:
[0051] Traditional derivatives markets by contrast, operate largely under a house "banking" system. In this system, the market-maker, which typically has the function of matching buyers and sellers, customarily quotes a price at which an investor may buy or sell. If a given investor buys or sells at the price, the investor's ultimate return is based upon this price, i.e., the price at which the investor later sells or buys the original position, along with the original price at which the position was traded, will determine the investor's return. As the market-maker may not be able perfectly to offset buy and sell orders at all times or may desire to maintain a degree of risk in the expectation of returns, it will frequently be subject to varying degrees of market risk (as well as credit risk, in some cases). In a traditional derivatives market, market-makers which match buy and sell orders typically rely upon actuarial advantage, bid-offer spreads, a large capital base, and "coppering" or hedging (risk management) to minimize the chance of bankruptcy due to such market risk exposures.

Summary of Invention Paragraph:
[0060] In preferred embodiments of a method for conducting demand-based trading of the present invention, at least one investment of value units is a multi-state investment that designates a set of defined states. In a further preferred embodiment, at least one multi-state investment designates a set of desired returns that is responsive to the designated set of defined states, and the allocating step is further responsive to the set of desired returns. In a further preferred embodiment, each desired return of the set of desired returns is responsive to a subset of the designated set of defined states. In an alternative preferred embodiment, the set of desired returns approximately corresponds to expected returns from a set of defined states of a prespecified investment vehicle such as, for example, a particular call option.

Summary of Invention Paragraph:
[0068] Another preferred embodiment of a method for conducting demand-based trading includes the steps of: (a) establishing a plurality of defined states and a plurality of predetermined termination criteria, wherein each of the defined states corresponds to one possible outcome of an event of economic significance (or a financial instrument); (b) accepting, prior to fulfillment of all of the termination criteria, an investment of value units by each of a plurality of traders in at least one of the plurality of defined states, with at least one investment designating a range of possible outcomes corresponding to a set of defined states; and (c) allocating a payout to each investment. In such a preferred embodiment, the allocating step is responsive to the total number of value units in the plurality of defined states, the relative number of value units invested in each of the defined states, and an identification of the defined state that occurred upon the fulfillment of all of the termination criteria. Also in such a preferred embodiment, the allocation is done so that substantially the same payout is allocated to each state of the set of defined states. This embodiment contemplates, among other implementations, a market or exchange for contingent claims of the present invention that provides--without traditional sellers--profit and loss scenarios comparable to those expected by traders in derivative securities known as digital options, where payout is the same if the option expires anywhere in the money, and where there is no payout if the option expires out of the money.

Summary of Invention Paragraph:
[0069] Another preferred embodiment of the present invention provides a method for conducting demand-based trading including: (a) establishing a plurality of defined states and a plurality of predetermined termination criteria, wherein each of the defined states corresponds to one possible outcome of an event of economic significance (or a financial instrument); (b) accepting, prior to fulfillment of all of the termination criteria, a conditional investment order by a trader in at

least one of the plurality of defined states; (c) computing, prior to fulfillment of all of the termination criteria a probability corresponding to each defined state; and (d) executing or withdrawing, prior to the fulfillment of all of the termination criteria, the conditional investment responsive to the computing step. In such embodiments, the computing step is responsive to the total number of value units invested in the plurality of defined states and the relative number of value units invested in each of the plurality of defined states. Such embodiments contemplate, among other implementations, a market or exchange (again without traditional sellers) in which investors can make and execute conditional or limit orders, where an order is executed or withdrawn in response to a calculation of a probability of the occurrence of one or more of the defined states.Preferred embodiments of the system of the present invention involve the use of electronic technologies, such as computers, computerized databases and telecommunications systems, to implement methods for conducting demand-based trading of the present invention.

Brief Description of Drawings Paragraph:
[0113] FIG. 9b is a schematic of investor relationships for an illustrative group of DBAR contingent claims.

Brief Description of Drawings Paragraph:
[0114] FIG. 9c shows a tabulation of credit ratings and margin trades for each investor in to an illustrative group of DBAR contingent claims.

Detail Description Paragraph:
[0192] Preferred embodiments of the DBAR contingent claim and exchange of the present invention present four principal advantages in managing the credit risk inherent in leveraged transactions. First, a preferred form of DBAR contingent claim entails limited liability investing. Investment liability is limited in these embodiments in the sense that the maximum amount a trader can lose is the amount invested. In this respect, the limited liability feature is similar to that of a long option position in the traditional markets. By contrast, a short option position in traditional markets represents a potentially unlimited liability investment since the downside exposure can readily exceed the option premium and is, in theory, unbounded. Importantly, a group of DBAR contingent claims of the present invention can easily replicate returns of a traditional short option position while maintaining limited liability. The limited liability feature of a group of DBAR contingent claims is a direct consequence of the demand-side nature of the market. More specifically, in preferred embodiments there are no sales or short positions as there are in the traditional markets, even though traders in a group of DBAR contingent claims may be able to attain the return profiles of traditional short positions.

Detail Description Paragraph:
[0224] Preferred embodiments of the method of the present invention include the ability to improve the market's efficiency on an ongoing basis. This may readily be accomplished, for example, by comparing the predicted returns on a group of DBAR contingent claims returns with actual realized outcomes. If investors have rational expectations, then DBAR contingent claim returns will, on average, reflect trader expectations, and these expectations will themselves be realized on average. In preferred embodiments, efficiency measurements are made on defined states and investments over the entire distribution of possible outcomes, which can then be used for statistical time series analysis with realized outcomes. The network implementation of the present invention may therefore include analytic servers to perform these analyses for the purpose of continually improving the efficiency of the market.

Detail Description Paragraph:
[0262] A preferred embodiment of a DRF that can be used to implement a group of DBAR contingent claims is termed a "canonical" DRF. A canonical DRF is a type of

DRF which has the following property: upon the occurrence of a given state i, investors who have invested in that state receive a payout per unit invested equal to (a) the total amount traded for all the states less the transaction fee, divided by (b) the total amount invested in the occurring state. A canonical DRF may employ a transaction fee which may be a fixed percentage of the total amount traded, T, although other transaction fees are possible. Traders who made investments in states which not did occur receive zero payout. Using the notation developed above: 3 i , j = (1 - f) * T T i

Detail Description Paragraph:
[0290] In a preferred embodiment of a group of DBAR contingent claims with a canonical DRF, returns which represent the percentage return per unit of investment are closely related to payouts. Such returns are also closely related to the notion of a financial return familiar to investors. For example, if an investor has purchased a stock for $100 and sells it for $110, then this investor has realized a return of 10% (and a payout of $110).

Detail Description Paragraph:
[0328] A lognormal distribution is chosen for this illustration since it is commonly employed by derivatives traders as a distributional assumption for the purpose of evaluating the prices of options and other derivative securities. Accordingly, for purposes of this illustration it is assumed that all traders agree that the underlying distribution of states for the security are lognormally distributed such that: 27 V ~ = (V Z (,) - D (,) Z (,)) * e - 2 / 2 * (-) * e * - * dz

Detail Description Paragraph:
[0338] In preferred embodiments of groups of DBAR contingent claims, traders can invest in none, one or many states. It may be possible in preferred embodiments to allow traders efficiently to invest in a set, subset or combination of states for the purposes of generating desired distributions of payouts across the states. In particular, traders may be interested in replicating payout distributions which are common in the traditional markets, such as payouts corresponding to a long stock position, a short futures position, a long option straddle position, a digital put or digital call option.

Detail Description Paragraph:
[0353] Assumptions regarding the likely distribution of traded amounts for a group of DBAR contingent claims may be used, for example, to compute returns for each defined state per unit of amount invested at the beginning of a trading period ("opening returns"). For various reasons, the amount actually invested in each defined state may not reflect the assumptions used to calculate the opening returns. For instance, investors may speculate that the empirical distribution of returns over the time horizon may differ from the no-arbitrage assumptions typically used in option pricing. Instead of a lognormal distribution, more investors might make investments expecting returns to be significantly positive rather than negative (perhaps expecting favorable news). In Example 3.1.1, for instance, if traders invested more in states above $85 for the price of MSFT common stock, the returns to states below $85 could therefore be significantly higher than returns to states above $85.

Detail Description Paragraph:
[0354] In addition, it is well known to derivatives traders that traded option prices indicate that price distributions differ markedly from theoretical lognormality or similar theoretical distributions. The so-called volatility skew or "smile" refers to out-of-the-money put and call options trading at higher implied volatilities than options closer to the money. This indicates that traders often expect the distribution of prices to have greater frequency or mass at the extreme observations than predicted according to lognormal distributions. Frequently, this effect is not symmetric so that, for example, the probability of large lower price

outcomes are higher than for extreme upward outcomes. Consequently, in a group of DBAR contingent claims of the present invention, investment in states in these regions may be more prevalent and, therefore, finalized returns on outcomes in those regions lower. For example, using the basic DBAR contingent claim information from Example 3.1.1, the following returns may prevail due to investor expectations of return distributions that have more frequent occurrences than those predicted by a lognormal distribution, and thus are skewed to the lower possible returns. In statistical parlance, such a distribution exhibits higher kurtosis and negative skewness in returns than the illustrative distribution used in Example 3.1.1 and reflected in Table 3.1.1-1.

Detail Description Paragraph:
[0358] If investor expectations coincide with the often-used assumption of the lognormal distribution, as reflected in this example, then investment activity in the group of contingent claims reflected in Table 3.1.4-1will converge to investment of the same amount in each of the 20 states identified in the table. Of course, actual trading will likely yield final market returns which deviate from those initially chosen for convenience using a lognormal distribution.

Detail Description Paragraph:
[0468] The securities and derivatives communities frequently use the term "exotic derivatives" to refer to derivatives whose values are linked to a security, asset, financial product or source of financial risk in a more complicated fashion than traditional derivatives such as futures, call options, and convertible bonds. Examples of exotic derivatives include American options, Asian options, barrier options, Bermudan options, chooser and compound options, binary or digital options, lookback options, automatic and flexible caps and floors, and shout options.

Detail Description Paragraph:
[0469] Many types of exotic options are currently traded. For example, barrier options are rights to purchase an underlying financial product, such as a quantity of foreign currency, for a specified rate or price, but only if, for example, the underlying exchange rate crosses or does not cross one or more defined rates or "barriers." For example, a dollar call/yen put on the dollar/yen exchange rate, expiring in three months with strike price 110 and "knock-out" barrier of 105, entitles the holder to purchase a quantity of dollars at 110 yen per dollar, but only if the exchange rate did not fall below 105 at any point during the three month duration of the option. Another example of a commonly traded exotic derivative, an Asian option, depends on the average value of the underlying security over some time period. Thus, a class of exotic derivatives is commonly referred to as "path-dependent" derivatives, such as barrier and Asian options, since their values depend not only on the value of the underlying financial product at a given date, but on a history of the value or state of the underlying financial product.

Detail Description Paragraph:
[0476] Investment and capital budgeting choices faced by firms typically involve inherent economic risk (e.g., future demand for semiconductors), large capital investments (e.g., semiconductor fabrication capacity) and timing (e.g., a decision to invest in a plant now, or defer for some period of time). Many economists who study such decisions under uncertainty have recognized that such choices involve what they term "real options." This characterization indicates that the choice to invest now or to defer an investment in goods or services or a plant, for example, in the face of changing uncertainty and information, frequently entails risks similar to those encountered by traders who have invested in options which provide the opportunity to buy or sell an underlying asset in the capital markets. Many economists and investors recognize the importance of real options in capital budgeting decisions and of setting up markets to better manage their uncertainty and value. Natural resource and extractive industries, such as petroleum exploration and production, as well as industries requiring large capital

investments such as technology manufacturing, are prime examples of industries where real options analysis is increasingly used and valued.

Detail Description Paragraph:
[0506] An example illustrates how this feature of the present invention may be implemented. The example illustrates the hedging of a European digital call option on the yen/dollar exchange rate (a traditional market option) over a two day period during which the underlying exchange rate changes by one yen per dollar. In this example, two trading periods are assumed for the group of DBAR contingent claims

Detail Description Paragraph:
[0508] Table 3.1.19-1 shows how the digital call option struck at 120 could, as an example, change in value with an underlying change in the yen/dollar exchange rate. The second column shows that the option is worth 28.333% or $28.333 million on a $100 million notional on 8/12/99 when the underlying exchange rate is 115.55. The third column shows that the value of the option, which pays $100 million should dollar yen equal or exceed 120 at the expiration date, increases to 29.8137% or $29.8137 million per $100 million when the underlying exchange rate has increased by 1 yen to 116.55. Thus, the traditional digital call option generates a profit of $29.81377-$28.333=$1.48077 million.

Detail Description Paragraph:
[0520] If H is to be invested in more than one state, then a multi-state allocation among the constituent states can be performed using the methods and procedures described above. This expression for H allows investors in DBAR contingent claims to calculate the investment amounts for hedging transactions. In the traditional markets, such calculations are often complex and quite difficult.

Detail Description Paragraph:
[0522] As previously discussed in this specification, the units of investments and payouts used in embodiments of the present invention can be any unit of economic value recognized by investors, including, for example, currencies, commodities, number of shares, quantities of indices, amounts of swap transactions, or amounts of real estate. The invested amounts and payouts need not be in the same units and can comprise a group or combination of such units, for example 25% gold, 25% barrels of oil, and 50% Japanese Yen. The previous examples in this specification have generally used U.S. dollars as the value units for investments and payouts.

Detail Description Paragraph:
[0528] An advantage of the systems and methods of the present invention is that, in preferred embodiments, traders can generate an arbitrary distribution of payouts across the distribution of defined states for a group of DBAR contingent claims. The ability to generate a customized payout distribution may be important to traders, since they may desire to replicate contingent claims payouts that are commonly found in traditional markets, such as those corresponding to long positions in stocks, short positions in bonds, short options positions in foreign exchange, and long option straddle positions, to cite just a few examples. In addition, preferred embodiments of the present invention may enable replicated distributions of payouts which can only be generated with difficulty and expense in traditional markets, such as the distribution of payouts for a long position in a stock that is subject to being "stopped out" by having a market-maker sell the stock when it reaches a certain price below the market price. Such stop-loss orders are notoriously difficult to execute in traditional markets, and traders are frequently not guaranteed that the execution will occur exactly at the pre-specified price.

Detail Description Paragraph:
[0536] Example 3.1.21 illustrates a methodology for generating an arbitrary payout distribution, using the event, termination criteria, the defined states, trading period and other relevant information, as appropriate, from Example 3.1.1, and

assuming that the desired multi-state investment is small in relation to the total amount of investments already made. In Example 3.1.1 above, illustrative investments are shown across the distribution of states representing possible closing prices for MSFT stock on the expiration date of Aug. 19, 1999. In that example, the distribution of investment is illustrated for Aug. 18, 1999, one day prior to expiration, and the price of MSFT on this date is given as 85. For purposes of this Example 3.1.21, it is assumed that a trader would like to invest in a group of DBAR contingent claims according to the present invention in a way that approximately replicates the profits and losses that would result from owning one share of MSFT (i.e., a relatively small amount) between the prices of 80 and 90. In other words, it is assumed that the trader would like to replicate a traditional long position in MSFT with the restrictions that a sell order is to be executed when MSFT reaches 80 or 90. Thus, for example, if MSFT closes at 87 on Aug. 19, 1999 the trader would expect to have $2 of profit from appropriate investments in a group of DBAR contingent claims. Using the defined states identified in Example 3.1.1, this profit would be approximate since the states are defined to include a range of discrete possible closing prices.

Detail Description Paragraph:
[0539] Pertinently the systems and methods of the present invention may be used to achieve almost any arbitrary payout or return profile, e.g., a long position, a short position, an option "straddle", etc., while maintaining limited liability and the other benefits of the invention described in this specification.

Detail Description Paragraph:
[0543] In a preferred embodiment of a DBARP involving different events relating to different financial products, a DRF is employed in which returns for each contingent claim in the portfolio are determined by (i) the actual magnitude of change for each underlying financial product and (ii) how much has been invested in each state in the distribution. A large amount invested in a financial product, such as a common stock, on the long side will depress the returns to defined states on the long side of a corresponding group of DBAR contingent claims. Given the inverse relationship in preferred embodiments between amounts invested in and returns from a particular state, one advantage to a DBAR portfolio is that it is not prone to speculative bubbles. More specifically, in preferred embodiments a massive influx of long side trading, for example, will increase the returns to short side states, thereby increasing returns and attracting investment in those states.

Detail Description Paragraph:
[0573] The returns in this example and in preferred embodiments are a function not only of the amounts invested in each group of DBAR contingent claims, but also the relative magnitude of the changes in prices for the underlying financial products or in the values of the underlying events of economic performance. In this specific example, the MSFT traders receive higher returns since MSFT significantly outperformed IBM. In other words, the MSFT longs were "more correct" than the IBM shorts.

Detail Description Paragraph:
[0640] In preferred embodiments of the present invention, a trader may make investments in a group of DBAR contingent claims using a margin loan. In preferred embodiments of the present invention implementing DBAR digital options, an investor may make an investment with a profit and loss scenario comparable to a sale of a digital put or call option and thus have some loss if the option expires "in the money," as discussed in Section 6, below. In preferred embodiments, credit risk may be measured by estimating the amount of possible loss that other traders in the group of contingent claims could suffer owing to the inability of a given trader to repay a margin loan or otherwise cover a loss exposure. For example, a trader may have invested $1 in a given state for a group of DBAR contingent claims with $.50 of margin. Assuming a canonical DRF for this example, if the state later fails to

occur, the DRF collects $1 from the trader (ignoring interest) which would require repayment of the margin loan. As the trader may be unable to repay the margin loan at the required time, the traders with successful trades may potentially not be able to receive the full amounts owing them under the DRF, and may therefore receive payouts lower than those indicated by the finalized returns for a given trading period for the group of contingent claims. Alternatively, the risk of such possible losses due to credit risk may be insured, with the cost of such insurance either borne by the exchange or passed on to the traders. One advantage of the system and method of the present invention is that, in preferred embodiments, the amount of credit risk associated with a group of contingent claims can readily be calculated.

Detail Description Paragraph:
[0653] Step (i) of the MCS methodology is to estimate a statistical distribution of the events of interest. In computing CCAR for a group of DBAR contingent claims, the events of interest may be both the primary events underlying the groups of DBAR contingent claims, including events that may be fitted to multivariate statistical distributions to compute CAR as described above, as well as the events related to the default of the other investors in the groups of DBAR contingent claims. Thus, in a preferred embodiment, the multivariate statistical distribution to be estimated relates to the market events (e.g., stock price changes, changes in interest rates) underlying the groups of DBAR contingent claims being analyzed as well as the event that the investors in those groups of DBAR contingent claims, grouped by credit rating or classification will be unable to repay margin loans for losing investments.

Detail Description Paragraph:
[0654] For example, a multivariate statistical distribution to be estimated might assume that changes in the market events and credit ratings or classifications are jointly normally distributed. Estimating such a distribution would thus entail estimating, for example, the mean changes in the underlying market events (e.g., expected changes in interest rates until the expiration date), the mean changes in credit ratings expected until expiration, the standard deviation for each market event and credit rating change, and a correlation matrix containing all of the pairwise correlations between every pair of events, including market and credit event pairs. Thus, a preferred embodiment of MCS methodology as it applies to CCAR estimation for groups of DBAR contingent claims of the present invention typically requires some estimation as to the statistical correlation between market events (e.g., the change in the price of a stock issue) and credit events (e.g., whether an investor rated A- by Standard and Poors is more likely to default or be downgraded if the price of a stock issue goes down rather than up).

Detail Description Paragraph:
[0656] A preferred approach to estimating correlation between events is to use a source of data with regard to credit-related events which does not typically suffer from a lack of statistical frequency. Two methods can be used in this preferred approach. First, data can be obtained which provide greater statistical confidence with regard to credit-related events. For example, expected default frequency data can be purchased from such companies as KMV Corporation. These data supply probabilities of default for various parties which can be updated as frequently as daily. Second, more frequently observed default probabilities can be estimated from market interest rates. For example, data providers such as Bloomberg and Reuters typically provide information on the additional yield investors require for investments in bonds of varying credit ratings, e.g., AAA, AA, A, A-. Other methods are readily available to one skilled in the art to provide estimates regarding default probabilities for various entities. Such estimates can be made as frequently as daily so that it is possible to have greater statistical confidence in the parameters typically needed for MCS, such as the correlation between changes in default probabilities and changes in stock prices, interest rates, and exchange rates.

Detail Description Paragraph:
[0657] The estimation of such correlations is illustrated assuming two groups of DBAR contingent claims of interest, where one group is based upon the closing price of IBM stock in three months, and the other group is based upon the closing yield of the 30-year U.S. Treasury bond in three months. In this illustration, it is also assumed that the counterparties who have made investments on margin in each of the groups can be divided into five distinct credit rating classes. Data on the daily changes in the price of IBM and the bond yield may be readily obtained from such sources as Reuters or Bloomberg. Frequently changing data on the expected default probability of investors can be obtained, for example, from KMV Corporation, or estimated from interest rate data as described above. As the default probability ranges between 0 and 1, a statistical distribution confined to this interval is chosen for purposes of this illustration. For example, for purposes of this illustration, it can be assumed that the expected default probability of the investors follows a logistic distribution and that the joint distribution of changes in IBM stock and the 30-year bond yield follows a bivariate normal distribution. The parameters for the logistic distribution and the bivariate normal distribution can be estimated using econometric techniques known to one skilled in the art.

Detail Description Paragraph:
[0658] Step (ii) of a MCS technique, as it may be applied to estimating CCAR for groups of DBAR contingent claims, involves the use of the multivariate statistical distributions estimated in Step (i) above in order to simulate the representative scenarios. As described above, such simulations can be performed using methods and software readily available and known to those of skill in the art. For each simulated scenario, the simulated default rate can be multiplied by the amount of losses an investor faces based upon the simulated market changes and the margin, if any, the investor has used to make losing investments. The product represents an estimated loss rate due to investor defaults. Many such scenarios can be generated so that a resulting distribution of credit-related expected losses can be obtained. The average value of the distribution is the mean loss. The lowest value of the top fifth percentile of the distribution, for example, would correspond to a loss for which a given trader could be 95% confident would not be exceeded, provided that enough scenarios have been generated to provide a statistically meaningful sample. In preferred embodiments, the selected value in the distribution, corresponding to a desired or adequate confidence level, is used as the CCAR for the groups of DBAR contingent claims being analyzed.

Detail Description Paragraph:
[0662] Step (ii) involves using each observation in the historical data from the previous step (i) to compute payouts using the DRF for each group of DBAR contingent claims being analyzed. The amount of margin to be repaid for the losing trades, or the loss exposure for investments with profit and loss scenarios comparable to digital option "sales," can then be multiplied by the expected default probability to use HS to estimate CCAR, so that an expected loss number can be obtained for each investor for each group of contingent claims. These losses can be summed across the investment by each trader so that, for each historical observation data point, an expected loss amount due to default can be attributed to each trader. The loss amounts can also be summed across all the investors so that a total expected loss amount can be obtained for all of the investors for each historical data point.

Detail Description Paragraph:
[0663] Step (iii) involves arranging, in ascending order, the values of loss amounts summed across the investors for each data point from the previous step (iii). An expected loss amount due to credit-related events can therefore be computed corresponding to any percentile in the distribution so arranged. For example, a CCAR value corresponding to a 95% statistical confidence level can be

computed by reference to .sub.95th percentile of the loss distribution.

Detail Description Paragraph:
[0687] In a preferred embodiment, the DBAR methods and systems of the present invention may be used to implement financial products known as digital options and to facilitate an exchange in such products. A digital option (sometimes also known as a binary option) is a derivative security which pays a fixed amount should specified conditions be met (such as the price of a stock exceeding a given level or "strike" price) at the expiration date. If the specified conditions are met, a digital option is often characterized as finishing "in the money." A digital call option, for example, would pay a fixed amount of currency, say one dollar, should the value of the underlying security, index, or variable upon which the option is based expire at or above the strike price of the call option. Similarly, a digital put option would pay a fixed amount of currency should the value of the underlying security, index or variable be at or below the strike price of the put option. A spread of either digital call or put options would pay a fixed amount should the underlying value expire at or between the strike prices. A strip of digital options would pay out fixed ratios should the underlying expire between two sets of strike prices. Graphically, digital calls, puts, spreads, and strips can have simple representations:

Detail Description Paragraph:
[0691] As depicted in Tables 6.0.1, 6.0.2, 6.0.3, and 6.04, the strike prices for the respective options are marked using familiar options notation where the subscript "c" indicates a call, the subscript "p" indicates a put, the subscript "s" indicates "spread," and the superscripts "1" and "u" indicate lower and upper strikes, respectively.

Detail Description Paragraph:
[0692] A difference between digital options, which are frequently transacted in the OTC foreign currency options markets, and traditional options such as the equity options, which trade on the Chicago Board Options Exchange ("CBOE"), is that digital options have payouts which do not vary with the extent to which the underlying asset, index, or variable ("underlying") finishes in or out of the money. For example, a digital call option at a strike price for the underlying stock at 50 would pay the same amount if, at the fulfillment of all of the termination criteria, the underlying stock price was 51, 60, 75 or any other value at or above 50. In this sense, digital options represent the academic foundations of options theory, since traditional equity options could in theory be replicated from a portfolio of digital spread options whose strike prices are set to provide vanishingly small spreads. (In fact, a "butterfly spread" of the traditional options yields a digital option spread as the strike prices of the traditional options are allowed to converge.) As can be seen from Tables 6.0.1, 6.0.2, 6.0.3, and 6.04, digital options can be constructed from digital option spreads.

Detail Description Paragraph:
[0695] One advantage of the digital options representation of DBAR contingent claims is that the trader interface of a DBAR digital options exchange (a "DBAR DOE") can be presented in a format familiar to traders, even though the underlying DBAR market structure is quite novel and different from traditional securities and derivatives markets. For example, the main trader interface for a DBAR digital options exchange, in a preferred embodiment, could have the following features:

Detail Description Paragraph:
[0696] The illustrative interface of Table 6.1.1 contains hypothetical market information on DBAR digital options on Microsoft stock ("MSFT") for a given expiration date. For example, an investor who desires a payout if MSFT stock closes higher than 50 at the expiration or observation date will need to "pay the offer" of $0.4408 per dollar of payout. Such an offer is "indicative" (abbreviated "IND") since the underlying DBAR distribution--that is, the implied probability that a

state or set of states will occur may change during the trading period. In a preferred embodiment, the bid/offer spreads presented in Table 6.1.1 are presented in the following manner. The "offer" side in the market reflects the implied probability that underlying value of the stock (in this example MSFT) will finish "in the money." The "bid" side in the market is the "price" at which a claim can be "sold" including the transaction fee. (In this context, the term "sold" reflects the use of the systems and methods of the present invention to implement investment profit and loss scenarios comparable to "sales" of digital options, discussed in detail below.) The amount in each "offer" cell is greater than the amount in the corresponding "bid" cell. The bid/offer quotations for these digital option representations of DBAR contingent claims are presented as percentages of (or implied probabilities for) a one dollar indicative payout.

Detail Description Paragraph:
[0699] As explained in detail below, in preferred embodiments of the systems and methods of the present invention, traders or investors cay buy and "sell" DBAR contingent claims that are represented and behave like digital option puts, calls, spreads, and strips using conditional or "limit" orders. In addition, these digital options can be processed using existing technological infrastructure in place at current financial institutions. For example, Sungard, Inc., has a large subscriber base to many off-the-shelf programs which are capable of valuing, measuring the risk, clearing, and settling digital options. Furthermore, some of the newer middleware protocols such as FINXML (see www.finxml.org) apparently are able to handle digital options and others will probably follow shortly (e.g., FPML). In addition, the transaction costs of a digital options exchange using the methods and systems of the present invention can be represented in a manner consistent with the conventional markets, i.e., in terms of bid/offer spreads.

Detail Description Paragraph:
[0701] The methods of multistate trading of DBAR contingent claims previously disclosed can be used to implement investment in a group of DBAR contingent claims that behave like a digital option. In particular, and in a preferred embodiment, this can be accomplished by allocating an investment, using the multistate methods previously disclosed, in such a manner that the same payout is received from the investment should the option expire "in-the-money", e.g., above the strike price of the underlying for a call option and below the strike price of the underlying for a put. In a preferred embodiment, the multistate methods used to allocate the investment need not be made apparent to traders. In such an embodiment, the DBAR methods and systems of the present invention could effectively operate "behind the scenes" to improve the quality of the market without materially changing interfaces and trading screens commonly used by traders. This may be illustrated by considering the DBAR construction of the MSFT Digital Options market activity as represented to the user in Table 6.1.1. For purposes of this illustration, it is assumed that the market "prices" or implied probabilities for the digital put and call options as displayed in Table 6.1.1 result from $100 million in investments. The DBAR states and allocated investments which construct these "prices" are then:

Detail Description Paragraph:
[0704] A digital call or put may be constructed with DBAR methods of the present invention by using the multistate allocation algorithms previously disclosed. In a preferred embodiment, the construction of a digital option involves allocating the amount to be invested across the constituent states over which the digital option is "in-the-money" (e.g., above the strike for a call, below the strike for a put) in a manner such that the same payout is obtained regardless of which state occurs among the "in the money" constituent states. This is accomplished by allocating the amount invested in the digital option in proportion to the then-existing investments over the range of constituent states for which the option is "in the money." For example, for an additional $1,000,000 investment a digital call struck at 50 from the investments illustrated in Table 6.2.1, the construction of the trade using multistate allocation methods is:

Detail Description Paragraph:
[0707] In a preferred embodiment, a digital option spread trade may be offered to investors which simultaneously execute a buy and a "sell" (in the synthetic or replicated sense of the term, as described below) of a digital call or put option. An investment in such a spread would have the same payout should the underlying outcome expire at any value between the lower and upper strike prices in the spread. If the spread covers one state, then the investment is comparable to an investment in a DBAR contingent claim for that one state. If the spread covers more than one constituent state, in a preferred embodiment the investment is allocated using the multistate investment method previously described so that, regardless of which state occurs among the states included in the spread trade, the investor receives the same payout.

Detail Description Paragraph:
[0710] In a preferred embodiment, the DBAR methods of the present invention can be used to allow traders to construct strips of digital options and digital option spreads whose relative payout ratios, should each option expire in the money, are equal to the ratios specified by the trader. For example, a trader may desire to invest in a strip consisting of the 50, 60, 70, and 80 digital call options on MSFT, as illustrated in Table 6.1.1. Furthermore, and again as an illustrative example, the trader may desire that the payout ratios, should each option expire in the money, be in the following relative ratio: 1:2:3:4. Thus, should the underlying price of MSFT at the expiration date (when the event outcome is observed) be equal to 65, both the 50 and 60 strike digital options are in the money. Since the trader desires that the 60 strike digital call option pay out twice as much as the 50 strike digital call option, a multistate allocation algorithm, as previously disclosed and described in detail, can be used dynamically to reallocate the trader's investments across the states over which these options are in the money (50 and above, and 60 and above, respectively) in such a way as to generate final payouts which conform to the indicated ratio of 1:2. As previously disclosed, the multistate allocation steps may be performed each time new investments are added during the trading period, and a final multistate allocation may be performed after the trading period has expired.

Detail Description Paragraph:
[0713] In traditional markets, the act of selling a digital option, spread, or strip means that the investor (in the case of a sale, a seller) receives the cost of the option, or premium, if the option expires worthless or out of the money. Thus, if the option expires out of the money, the investor/seller's profit is the premium. Should the option expire in the money, however, the investor/seller incurs a net liability equal to the digital option payout less the premium received. In this situation, the investor/seller's net loss is the payout less the premium received for selling the option, or the notional payout less the premium. Selling an option, which is equivalent in many respects to the activity of selling insurance, is potentially quite risky, given the large contingent liabilities potentially involved. Nonetheless, option selling is commonplace in conventional, non-DBAR markets.

Detail Description Paragraph:
[0714] As indicated above, an advantage of the digital options representation of the DBAR methods of the present invention is the presentation of an interface which displays bids and offers and therefore, by design, allows users to make investments in sets of DBAR contingent claims whose P&L scenarios are comparable to those from traditional "sales" as well as purchases of digital calls, puts, spreads, and strips. Specifically in this context, "selling" entails the ability to achieve a profit and loss profile which is analogous to that achieved by sellers of digital options instruments in non-DBAR markets, i.e., achieving a profit equal to the premium should the digital option expire out of the money, and suffering a net loss equal to the digital option payout (or the notional) less the premium received

should the digital option expire in the money.

Detail Description Paragraph:
[0715] In a preferred embodiment of a digital options exchange using the DBAR contingent claims methods and systems of the present invention, the mechanics of "selling" involves converting such "sell" orders to complementary buy orders. Thus, a sale of the MSFT digital put options with strike price equal to 50, would be converted, in a preferred DBAR-DOE embodiment, to a complementary purchase of the 50 strike digital call options. A detailed explanation of the conversion process of a "sale" to a complementary buy order is provided in connection with the description of FIG. 15.

Detail Description Paragraph:
[0720] In another preferred embodiment, an investor may be able to specify the amount of premium to be "sold." To illustrate this embodiment, quantity of premium to be "sold" can be assigned to the variable x. An investment of quantity y on the states complementary to the range of states being "sold" is related to the premium x in the following manner: 64 y 1 - p - y = x

Detail Description Paragraph:
[0724] It should be emphasized that the traditional markets differ from the systems and methods of the present invention in as least one fundamental respect. In traditional markets, the sale of an option requires a seller who is willing to sell the option at an agreed-upon price. An exchange of DBAR contingent claims of the present invention, in contrast, does not require or involve such sellers. Rather, appropriate investments may be made (or bought) in contingent claims in appropriate states so that the payout to the investor is the same as if the claim, in a traditional market, had been sold. In particular, using the methods and systems of the present invention, the amounts to be invested in various states can be calculated so that the payout profile replicates the payout profile of a sale of a digital option in a traditional market, but without the need for a seller. These steps are described in detail in connection with FIG. 15.

Detail Description Paragraph:
[0726] In a preferred embodiment of a digital options exchange using the DBAR contingent claims systems and methods of the present invention, all types of positions may be processed as digital options. This is because at fixing (i.e., the finalization of contingent claim "prices" or implied probabilities at the termination of the trading period or other fulfillment of all of the termination criteria) the profit and loss expectations of all positions in the DBAR exchange are, from the trader's perspective, comparable to if not the same as the profit and loss expectations of standard digital options commonly traded in the OTC markets, such as the foreign exchange options market (but without the presence of actual sellers, who are needed on traditional options exchanges or in traditional OTC derivatives markets). The contingent claims in a DBAR-DOE of the present invention, once fmalized at the end of a trading period, may therefore be processed as digital options or combinations of digital options. For example, a MSFT digital option call spread with a lower strike of 40 and upper strike of 60 could be processed as a purchase of the lower strike digital option and a sale of the upper strike digital option.

Detail Description Paragraph:
[0727] There are many vendors of back office software which can readily handle the processing of digital options. For example, Sungard, Inc., produces a variety of mature software systems for the processing of derivatives securities, including digital options. Furthermore, in-house derivatives systems currently in use at major banks have basic digital options capability. Since digital options are commonly encountered instruments, many of the middleware initiatives currently underway e.g., FINXML, will likely incorporate a standard protocol for handling digital options. Therefore, an advantage of a preferred embodiment of the DBAR-DOE

of the present invention is the ability to integrate with and otherwise use existing technology for such an exchange.

Detail Description Paragraph:
[0730] In a preferred embodiment, these initial distributions may be represented as investments in each of the defined states making up the contract or group of DBAR contingent claims. Since these investments need not be actual trader investments, they may be reallocated among the defined states as actual trading occurs, so long as the initial investments do not change the implicit probabilities of the states resulting from actual investments. In a preferred embodiment, the reallocation of initial investments is performed gradually so as to maximize the stability of digital call and put "prices" (and spreads), as viewed by investors. By the end of the trading period, all of the initial investments may be reallocated in proportion to the investments in each of the defined states made by actual traders. The reallocation process may be represented as a composite trade which has a same payout irrespective of which of the defined states occurs. In preferred embodiments the initial distribution can be chosen using current market indications from the traditional markets to provide guidance for traders, e.g., options prices from traditional option markets can be used to calculate a traditional market consensus probability distribution, using for example, the well-known technique of Breeden and Litzenberger. Other reasonable initial and indicative distributions could be used. Altematively, in a preferred embodiment, initialization can be performed in such a manner that each defined state is initialized with a very small amount, distributed equally among each of the defined states. For example, each of the defined states could be initialized with 10-6 value units. Initialization in this manner is designed to start each state with a quantity which is very small, distributed so as to provide a very small amount of information regarding the implied probability of each defined state. Other initialization methods of the defined states are possible and could be implemented by one of skill in the art.

Detail Description Paragraph:
[0732] In a preferred embodiment of the system and methods of the present invention, traders may be able to make investments which are only binding if a certain "price" or implied probability for a given state or digital option (or strip, spread, etc.) is achieved. In this context, the word "price," is used for convenience and familiarity and, in the systems and methods of the present invention, reflects the implied probability of the occurrence of the set of states corresponding to an option--i.e., the implied probability that the option expires "in the money." For instance, in the example reflected in Table 6.2.1, a trader may wish to make an investment in the MSFT digital call options with strike price of 50, but may desire that such an investment actually be made only if the fmal equilibrium "price" or implied probability is 0.42 or less. Such a conditional investment, which is conditional upon the final equilibrium "price" for the digital option, is sometimes referred to (in conventional markets) as a "limit order." Limit orders are popular in traditional markets since they provide the means for investors to execute a trade at "their price" or better. Of course, there is no guarantee that such a limit order--which may be placed significantly away from the current market price--will in fact be executed. Thus, in traditional markets, limit orders provide the means to control the price at which a trade is executed, without the trader having to monitor the market continuously. In the systems and method of the present invention, limit orders provide a way for investors to control the likelihood that their orders will be executed at their preferred "prices" (or better), also without having continuously to monitor the market.

Detail Description Paragraph:
[0733] In a preferred embodiment of a DBAR-DOE, traders are permitted to buy and sell digital call and put options, digital spreads, and digital strips with limit "prices" attached. The limit "price" indicates that a trader desires that his trade be executed at that indicated limit "price"--actually the implied probability that the option will expire in the money--"or better." In the case of a purchase of a

digital option, "better" means at the indicated limit "price" implied probability or lower (i.e., purchasing not higher than the indicated limit "price"). In the case of a "sale" of a DBAR digital option, "better" means at the indicated limit "price" (implied probability) or higher (i.e., selling not lower than the indicated limit "price").

Detail Description Paragraph:
[0734] A benefit of a preferred embodiment of a DBAR-DOE of the present invention which includes conditional investments or limit orders is that the placing of limit orders is a well-known mechanism in the financial markets. By allowing traders and investors to interact with a DBAR-DOE of the present invention using limit orders, more liquidity should flow into the DBAR-DOE because of the familiarity of the mechanism, even though the underlying architecture of the DBAR-DOE is different from the underlying architecture of other financial markets.

Detail Description Paragraph:
[0737] 6.8(2) Group the limit orders by placing all of the limit orders which span or comprise the same range of defined states into the same group. Sort each group from the best (highest "price" buy) to the worst (lowest "price" buy). All orders may be processed as buys since any "sales" have previously been converted to complementary buys. For example, in the context of the MSFT Digital Options illustrated in Table 6.2.1, there would be separate groups for the 30 digital calls, the 30 digital puts, the 40 digital calls, the 40 digital puts, etc. In addition, separate groups are made for each spread or strip which spans or comprises a distinct set of defined states.

Detail Description Paragraph:
[0765] As can be seen from Table 6.8.5, the "prices" of the call options have decreased while the "prices" of the put options have increased as a result of filling five lots of the 80 digital put options, as expected.

Detail Description Paragraph:
[0772] It may be possible only partially to execute or "fill" a trader's order at a given limit "price" or implied probability of the relevant states. For example, in the current illustration, the limit buy order for 50 puts at limit "price" equal to 0.52 for an order amount of 10000 may be only filled in the amount 2424 (see Table 6.8.8). If orders are made by more than one investor and not all of them can be filled or executed at a given equilibrium, in preferred embodiments it is necessary to decide how many of which investor's orders can be filled, and how many of which investor's orders will remain unfulfilled at that equilibrium. This may be accomplished in several ways, including by filling orders on a first-come-first-filled basis, or on a pro rata or other basis known or apparent to one of skill in the art. In preferred embodiments, investors are notified prior to the commencement of a trading period about the basis on which orders are filled when all investors' limit orders cannot be filled at a particular equilibrium.

Detail Description Paragraph:
[0774] In preferred embodiments of the present invention, traders in DBAR digital options may be provided with information regarding the quantity of a trade that could be executed ("filled") at a given limit "price" or implied probability for a given option, spread or strip. For example, consider the MSFT digital call option with strike of 50 illustrated in Table 6.1.1 above. Assume the current "price" or implied probability of the call option is 0.4408 on the "offer" side of the market. A trader may desire, for example, to know what quantity of value units could be transacted and executed at any given moment for a limit "price" which is better than the market. In a more specific example, for a purchase of the 50 strike call option, a trader may want to know how much would be filled at that moment were the trader to specify a limit "price" or implied probably of, for example, 0.46. This information is not necessarily readily apparent, since the acceptance of conditional investments (i.e., the execution of limit orders) changes the implied

probability or "price" of each of the states in the group. As the limit "price" is increased, the quantities specified in a buy order are more likely to be filled, and a curve can be drawn with the associated limit "price"/quantity pairs. The curve represents the amount that could be filled (for example, along the X-axis) versus the corresponding limit "price" or implied probability of the strike of the order (for example, along the Y-axis). Such a curve should be useful to traders, since it provides an indication of the "depth" of the DBAR-DOE for a given contract or group of contingent claims. In other words, the curve provides information on the "price" or implied probability, for example, that a buyer would be required to accept in order to execute a predetermined or specified number of value units of investment for the digital option.

Detail Description Paragraph:
[0776] In preferred embodiments, one or more operators of two or more different DBAR Digital Options Exchanges may synchronize the time at which trading periods are conducted (e.g., agreeing on the same commencement and predetermined termination criteria) and the strike prices offered for a given underlying event to be observed at an agreed upon time. Each operator could therefore be positioned to offer the same trading period on the same underlying DBAR event of economic significance or financial instrument. Such synchronization would allow for the aggregation of liquidity of two or more different exchanges by means of computing DBAR-DOE equilibria for the combined set of orders on the participating exchanges. This aggregation of liquidity is designed to result in more efficient "pricing" so that implied probabilities of the various states reflect greater information about investor expectations than if a single exchange were used.

Detail Description Paragraph:
[0780] In FIG. 1, a central controller 100 has a plurality software and hardware components and is embodied as a mainframe computer or a plurality of workstations. The central controller 100 is preferably located in a facility that has back-up power, disaster-recovery capabilities, and other similar infrastructure, and is connected via telecommunications links 110 with computers and devices 160, 170, 180, 190, and 200 of traders and investors in groups of DBAR contingent claims of the present invention. Signals transmitted using telecommunications links 110, can be encrypted using such algorithms as Blowfish and other forms of public and private key encryption. The telecommunications links 110 can be a dialup connection via a standard modem 120; a dedicated line connection establishing a local area network (LAN) or wide area network (WAN) 130 running, for example, the Ethernet network protocol; a public Internet connection 140; or wireless or cellular connection 150. Any of the computers and devices 160, 170, 180, 190 and 200, depicted in FIG. 1, can be connected using any of the links 120, 130, 140 and 150 as depicted in hub 111. Other telecommunications links, such as radio transmission, are known to those of skill in the art.

Detail Description Paragraph:
[0781] As depicted in FIG. 1, to establish telecommunications connections with the central controller 100, a trader or investor can use workstations 160 running, for example, UNIX, Windows NT, Linux, or other operating systems. In preferred embodiments, the computers used by traders or investors include basic input/output capability, can include a hard drive or other mass storage device, a central processor (e.g., an Intel-made Pentium III processor), random-access memory, network interface cards, and telecommunications access. A trader or investor can also use a mobile laptop computer 180, or network computer 190 having, for example, minimal memory and storage capability 190, or personal digital assistant 200 such as a Palm Pilot. Cellular phones or other network devices may also be used to process and display information from and communicate with the central controller 100.

Detail Description Paragraph:
[0783] In a preferred embodiment of central controller 100 depicted in FIG. 2, a

workstation software application server 210, such as the Weblogic Server available from BEA Systems, receives information via telecommunications links 110 from investors' computers and devices 160, 170, 180, 190 and 200. The software application server 210 is responsible for presenting human-readable user interfaces to investors' computers and devices, for processing requests for services from investors' computers and devices, and for routing the requests for services to other hardware and software components in the central controller 100. The user interfaces that can be available on the software application server 210 include hypertext markup language (HTML) pages, JAVA applets and servlets, JAVA or Active Server pages, or other forms of network-based graphical user interfaces known to those of skill in the art. For example, investors or traders connected via an Internet connection for HTML can submit requests to the software application server 210 via the Remote Method Invocation (RMI) and/or the Internet Inter-Orb Protocol (IIOP) running on top of the standard TCP/IP protocol. Other methods are known to those of skill in the art for transmitting investors' requests and instructions and presenting human readable interfaces from the application server 210 to the traders and investors. For example, the software application server 210 may host Active Server Pages and communicate with traders and investors using DCOM.

Detail Description Paragraph:
[0786] Representative requests for services from the investors' computers to the software application server 210 include: (1) requests for HTML pages (e.g., navigating and searching a web site); (2) logging onto the system for trading DBAR contingent claims; (3) viewing real-time and historical market data and market news; (4) requesting analytical calculations such as returns, market risk, and credit risk; (5) choosing a group of DBAR contingent claims of interest by navigating HTML pages and activating JAVA applets; (6) making an investment in one or more defined states of a group of DBAR contingent claims; and (7) monitoring investments in groups of DBAR contingent claims.

Detail Description Paragraph:
[0792] In a preferred embodiment depicted in FIG. 2, transaction server 240 is a computer running specialized software for performing various tasks including: (1) responding to data requests from the ORB 230, e.g., user, account, trade data and market data requests; (2) performing relevant computations concerning groups of DBAR contingent claims, such as intra-trading period and end-of-trading-period returns allocations and credit risk exposures; and (3) updating investor accounts based upon DRF payouts for groups of DBAR contingent claims and applying debits or credits for trader margin and positive outstanding investment balances. The transaction server 240 preferably processes all requests from the ORB 230 and, for those requests that require stored data (e.g., investor and account information), queries data storage devices 260. In a preferred embodiment depicted in FIG. 2, a market data feed 270 supplies real-time and historical market data, market news, and corporate action data, for the purpose of ascertaining event outcomes and updating trading period returns. The specialized software running on transaction server 240 preferably incorporates the use of object oriented techniques and principles available with computer languages such as C++ or Java for implementing the above-listed tasks.

Detail Description Paragraph:
[0794] In reference to FIG. 2, application server 210 and ORB 230 may be considered to form an interface processor, while transaction server 240 forms a demand-based transaction processor. Further, the databases hosted on data storage devices 260 may be considered to form a trade status database. Investors, also referred to as traders, communicating via telecommunications links 110 from computers and devices 160, 170, 180, 190, and 200, may be considered to perform a series of demand-based interactions, also referred to as demand-based transactions, with the demand-based transaction processor. A series of demand-based transactions may be used by a trader, for example, to obtain market data, to establish a trade, or to close out a trade.

Detail Description Paragraph:
[0795] FIG. 3 depicts a preferred embodiment of the implementation of a group of DBAR contingent claims. As depicted in FIG. 3, an exchange or issuer first selects an event of economic significance 300. In the preferred embodiment, the exchange then partitions the possible outcomes for the event into mutually exclusive and collectively exhaustive states 305, such that one state among the possible states in the partitioned distribution is guaranteed to occur, and the sum of probabilities of the occurrence of each partitioned state is unity. Trading can then commence with the beginning 311 of the first trading period 310. In the preferred embodiment depicted in FIG. 3, a group of DBAR contingent claims has trading periods 310, 320, 330, and 340, with trading period start date 311, 321, 331, 341 respectively, followed by a predetermined time interval by each trading period's respective trading end dates 313, 323, 333 and 343. The predetermined time interval is preferably of short duration in order to attain continuity. In the preferred embodiment, during each trading period the transaction server 240 running JAVA code implementing the DRF for the group of DBAR contingent claims adjusts returns immediately in response to changes in the amounts invested in each of the defined states. Changes in market conditions during a trading period, such as price and volatility changes, as well as changes in investor risk preferences and liquidity conditions in the underlying market, among other factors, will cause amounts invested in each defined state to change thereby reflecting changes in expectations of traders over the distribution of states defining the group of DBAR contingent claims.

Detail Description Paragraph:
[0799] In the preferred embodiment depicted in FIG. 3, at the close of the final trading period 343, trading ceases and the outcome for the event underlying the contingent claim is determined at close of observation period 350. In a preferred embodiment, only the outcome of the event underlying the group of contingent claims must be uncertain during the trading periods while returns are being locked in. In other words, the event underlying the contingent claims may actually have occurred before the end of trading so long as the actual outcome remains unknown, for example, due to the time lag in measuring or ascertaining the event's outcome. This could be the case, for instance, with macroeconomic statistics like consumer price inflation.

Detail Description Paragraph:
[0860] In a preferred embodiment of a DBAR-DOE of the present invention, limit orders may be the only order type that is processed. In a preferred embodiment, limit orders are executed and are part of the equilibrium for a group of DBAR contingent claims if their stipulated "price" conditions (i.e., probability of being in the money) are satisfied. For example, a trader may have placed limit buy order at 0.42 for MSFT digital call options with a strike price of 50. With a the limit condition at 0.42, the trader's order will be filled only if the final DBAR contingent claim distribution results in the 50 calls having a "price" which is 0.42 or "better," which, for a buyer of the call, means 0.42 or lower.

Detail Description Paragraph:
[0888] (vi) a vector which specifies the type of contingent claim to be traded (order.ratio[ ]). For example, in a preferred embodiment involving a contract with seven defined states, an order for a digital call option which would expire in the money should any of the last four states occur would be rendered in the data member order. ratio[ ] as order.ratio[0,0,0,1,1,1,1] where the 1's indicate that the same payout should be generated by the multistate allocation process when the digital option is in the money, and the 0's indicate that the option is out of the money, or expires on one of the respective out of the money states. As another example in a preferred embodiment, a spread which is in the money should states either states 1,2, 6, or 7 occur would be rendered as order.ratio[1,1,0,0,0,1,1]. As another example in a preferred embodiment, a digital option strip, which allows a trader to

specify the relative ratios of the final payouts owing to an investment in such a contingent claim would be rendered using the ratios over which the strip is in the money. For example, if a trader desires a strip which pays out three times much as state 3 should state 1 occur, and twice as much as state 3 if state 2 occurs, the strip would be rendered as order.ratio[3,2,1,0,0,0- ,0];

Detail Description Paragraph:
[0897] In a preferred embodiment depicted in FIG. 12, a separate grouping in step 1204 is required for each distinct order[j].ratio[ ] vector. Two order[j].ratio[ ] vectors are distinct for different orders when their difference yields a vector that does not contain zero in every element. For example, for a contract which contains seven defined states, a digital put option which spans that first three states has an order[1].ratio[ ] vector equal to (1,1,1,0,0,0,0). A digital call option which spans the last five states has an order[2].ratio[ ] vector equal to (0,0,1,1,1,1,1). Because the difference of these two vectors is equal to (1,1,0,-1,-1,-1,-1), these two orders should be placed into distinct groups, as indicated in step 1204.

Detail Description Paragraph:
[0899] The relevant groups of step 1204 of FIG. 12 are termed "composite" since they may span, or comprise, more than one of the defined states. For example, the MSFT Digital Option contract depicted above in Table 6.2.1, for example, has defined states (0,30], (30,40], (40,50], (50,60], (60, 70], (70, 80], and (80,00]. The 40 strike call options therefore span the five states (40,50], (50,60], (60, 70], (70, 80], and (80,00]. A "sale" of a 40 strike put, for example, would be converted at step 1203 into a complementary buy of a 40 strike call (with a limit "price" equal to one minus the limit "price" of the sold put), so both the "sale" of the 40 strike put and the buy of a 40 strike call would be aggregated into the same group for the purposes of step 1204 of FIG. 12.

Detail Description Paragraph:
[0904] Referring to Diagram 1 the call and put limit orders have been grouped by strike price (distinct order[j] .ratio[ ] vectors) and then ordered from "best price" to "worst," moving away from the horizontal axis. As shown in the table , "best price" for buy orders are those with higher prices (i.e., buyers with a higher willingness to pay). Diagram 1 includes "sales" of puts which have been converted to complementary purchases of calls and "sales" of calls which have been converted to complementary purchases of puts, i.e., all orders for the purposes of Diagram 1 may be treated as buy orders. For example, as depicted in Diagram 1 the grouping which includes the purchase of the 40 calls (labeled "C40") would also include any converted "sales" of the 40 puts (i.e., "sale" of the 40 puts has an order.ratio[ ] vector which originally is equal to (1,1,0,0,0,0,0) and is then converted to the complementary order.ratio[ ] vector (0,0,1,1,1,1,1) which corresponds to the purchase of a 40-strike call). Diagram 1 illustrates the groupings which span distinct sets of defined states with a vertical bar. The labels within each vertical bar in Diagram 1 such as "C 50", indicate whether the grouping corresponds to a call ("C") or put ("P") and the relevant strike price, e.g., "C50" indicates a digital call option with strike price of 50.

Detail Description Paragraph:
[0905] The horizontal lines within each vertical bar shown on Diagram 1 indicates the sorting by price within each group. Thus, for the vertical bar above the horizontal axis marked "C50" in Diagram 1, there are five distinct rectangular groupings within the vertical bar. Each of these groupings is an order for the digital call options with strike price 50 at a particular limit "price." By using the DBAR methods of the present invention, there is no matching of buyers and "sellers," or buy orders and "sell" orders, which is typically required in the traditional markets in order for transactions to take place. For example, Diagram 1 illustrates a set of orders which contains only buy orders for the digital puts struck at 70 ("P70").

Detail Description Paragraph:
[0907] Proceeding with the next step of the preferred embodiment depicted in FIG. 12, step 1207 queries whether there is at least a single order which has a limit "price" which is "better" than the current equilibrium "price" for the ordered option. In a preferred embodiment for the first iteration of step 1207 for a trading period for a group of DBAR contingent claims, the current equilibrium "prices" reflect the placement of the initial liquidity from step 1202. For example, with the seven defined states of the MSFT example described above, one value unit may have been initialized in each of the seven defined states. The "prices" of the 30, 40, 50, 60, 70, and 80 digital call options, are therefore {fraction (6/7)}, {fraction (5/7)}, {fraction (4/7)}, {fraction (3/7)}, {fraction (2/7)}, and {fraction (1/7)}, respectively. The initial "prices" of the 30, 40, 50, 60, 70, and 80 digital puts are {fraction (1/7)}, {fraction (2/7)}, {fraction (3/7)}, {fraction (4/7)}, {fraction (5/7)}, {fraction (6/7)}, respectively. Thus, step 1207 may identify a buy order for a 60 digital call option with limit "price" greater than {fraction (3/7)} (0.42857) or a "sell" order, for example, for the 40 digital put option with limit "price" less than {fraction (2/7)} (0.28571) (which would be converted into a buy order of the 40 calls with limit "price" of {fraction (5/7)} (i.e, 1-{fraction (2/7)})). In a preferred embodiment an order's limit "price" or implied probability would take into account transaction or exchange fees, since the limit "prices" of the original orders would have been already adjusted by the amount of the transaction fee (as contained in order[j].fee) from step 1205 of FIG. 12, where the function fee Adjust Orders( ) is invoked.

Detail Description Paragraph:
[0916] Referring now to the preferred embodiment of a method of composite multistate equilibrium calculation depicted FIG. 13, the function compEq( ), which is a multistate allocation algorithm, is described. In a preferred embodiment of a DBAR-DOE, digital options span or comprise more than one defined state, with each of the defined states corresponding to at least one possible outcome of an event of economic significance or a financial instrument. As depicted in Table 6.2.1 above, for example, the MSFT digital call option with strike price of 40 spans the five states above 40 or (40,50], (50,60], (60, 70], (70, 80], and (80,00]. To achieve a profit and loss scenario that traders conventionally expect from a digital option, in a preferred embodiment of the present invention a digital option investment of value units designates a set of defined states and a desired return-on-investment from the designated set of defined states, and the allocation of investments across these states is responsive to the desired return-on-investment from the designated set of defined states. For a digital option, the desired return on investment is often expressed as a desire to receive the same payout regardless of the state which occurs among the set of defined states which comprise the digital option. For instance, in the illustrative example of the MSFT stock prices shown in FIG. 6.2.1, a digital call option with strike price of 40 would be, in a preferred embodiment, allocated the same payout irrespective of which state of the five states above 40 occurs.

Detail Description Paragraph:
[0917] In preferred embodiments of the DBAR-DOE of the present invention, traders who invest in digital call options (or strips or spreads) specify a total amount of investment to be made (if the amount is for a buy order) or notional payout to be "sold" (if the amount is for a "sell" order). In a preferred embodiment, the total investment is then allocated using the compEq( ) multistate allocation method depicted in FIG. 13. In another preferred embodiment, the total amount of the payout to be received, should the digital option expire in the money, is specified by the investor, and in a preferred embodiment the investment amount required to produce such payouts are computed by the multistate allocation method depicted in FIG. 14.

Detail Description Paragraph:

[0918] In either embodiment, the investor specifies a desired return on investment from a designated set of defined states. A return on investment is the amount of value units received from the investment less the amount of value units invested, divided by the amount invested. In the embodiment depicted in FIG. 13, the amount of value units invested is specified and the amount of value units received, or the payout from the investment, is unknown until the termination criteria are fulfilled and the payouts are calculated. In the embodiment depicted in FIG. 14, the amount of value units to be paid out is specified but the investment amount to achieve that payout it is unknown until the termination criteria are fulfilled. The embodiment depicted in FIG. 13 is known as a composite trade, and the embodiment depicted in FIG. 14 is known as a profile trade.

Detail Description Paragraph:
[0919] Referring back to FIG. 13, step 1301 invokes a function call to the function profEq( ). This function handles those types of trades in which a desired return-on-investment for a designated set of defined states is specified by the trader indicating the payout amount to be received should any of the designated set of defined states occur. For example, a trader may indicate that a payout of $10,000 should be received should the MSFT digital calls stuck at 40 finish in the money. Thus, if MSFT stock is observed at the expiration date to have a price of 45, the investor receives $10,000. If the stock price were to be below 40, the investor would lose the amount invested, which is calculated using the function profEq( ). This type of desired return-on-investment trade is referred to as a multistate profile trade, and FIG. 14 depicts the detailed logical steps for a preferred embodiment of the profEq( ) function. In preferred embodiments of a DBAR-DOE of the present invention, there need not be any profile trades.

Detail Description Paragraph:
[0920] Referring back to FIG. 13, step 1302 initializes control loop counter variables. Step 1303 indicates a control loop which executes for each order. Step 1304 initializes the variable "norm" to zero and assigns the order being processed, order[j], to the order data structure. Step 1305 begins a control loop that executes for each of defined states which comprise a given order. For example, the MSFT digital call option with strike of 40 illustrated in Table 6.2.1 spans the five states which range from 40 and higher.

Detail Description Paragraph:
[0921] In the preferred embodiment depicted in FIG. 13, step 1306 executes while the number of states in the order are being processed to calculate of the variable norm, which is the weighted sum of the total investments for each state of the range of defined states which comprise the order. The weights are contained in order.ratio[i], which is a vector type member of the order data structure illustrated in FIG. 11 as previously described. For digital call options, whose payout is the same regardless of the defined state which occurs over the range of states for which the digital option is in the money, all of the elements of order.ratio[ ] are equal over the range. For trades involving digital strips, the ratios in order.ratio[ ] need not be equal. For example, a trader may desire a payout which is twice as great should a range of states occur compared to another range of states. The data member order.ratio[ ] would therefore contain information about this desired payout ratio.

Detail Description Paragraph:
[0928] As discussed above in a preferred embodiment of a DBAR-DOE, buy orders and "sell" order are interpreted somewhat differently. The amount of a buy order (as contained in the data structure member order.orderAmount) is interpreted as the amount of the investment to be allocated over the range of states spanning the contingent claim specified in the order. For example, a buy order for 100,000 value units for an MSFT digital call with strike price of 60 (order.ratio[ ]= (0,0,0,0,1,1,1) in the MSFT stock example depicted in Table 6.2.1) will be allocated among the states comprising the order so that, in the case of a digital

option, the same payout is received regardless of which constituent state of the range of states is realized. For a "sell" order the order amount (as also contained in the member data structure order.orderAmount) is interpreted to be the amount which the trader making the sale stands to lose if the contingent claim (i.e., digital option, spread, or strip) being "sold" expires in the money (i.e., any of the constituent states comprising the sale order is realized). Thus, the "sale" order amount is interpreted as a payout (or "notional" or "notional payout") less the option premium "sold," which is the amount that may be lost should the contingent claim "sold" expire in the money (assuming, that is, the entire order amount can be executed if the order is a limit order). A buy order, by contrast, has an order amount which is interpreted as an investment amount which will generate a payout whose magnitude is known only after the termination of trading and the final equilibrium prices finalized, should the option expire in the money. Thus, a buy order has a trade amount which is interpreted as in investment amount or option "premium" (using the language of the conventional options markets) whereas a DBAR-DOE "sell" order has an order amount which is interpreted to be a net payout equal to the gross payout lost, should the option sold expire in the money, less the premium received from the "sale." Thus, in a preferred embodiment of a DBAR-DOE, buy orders have order amounts corresponding to premium amounts, while "sell" orders have order amounts corresponding to net payouts.

Detail Description Paragraph:
[0953] Markets and exchanges according to the present invention provide mechanisms for efficient aggregation of information related to investor demand, implied probabilities of various outcomes, and price.

Detail Description Paragraph:
[0957] In preferred embodiments of systems and methods for investing in groups of DBAR contingent claims, an exchange need not, and typically will not, have a need to transact in the underlying physical financial products on which a group of DBAR contingent claims may be based. Securities and derivatives in those products need not be transferred, pledged, or otherwise assigned for value by the exchange, so that, in preferred embodiments, it does not need the infrastructure which is typically required for these back office activities.

Detail Description Paragraph:
[0965] Traditional financial product exchanges usually attach a proprietary interest in the real-time and historical data that is generated as a by-product from trading activity and market making. These data include, for example, price and volume quotations at the bid and offer side of the market. In traditional markets, price is a "sufficient statistic" for market participants and this is the information that is most desired by data subscribers. In preferred embodiments of systems and methods of the present invention for investing in groups of DBAR contingent claims, the scope of data generation may be greatly expanded to include investor expectations of the entire distribution of possible outcomes for respective future events on which a group of DBAR contingent claims can be based. This type of information (e.g., did the distribution at time t reflect traders' expectations of a market crash which occurred at time t+1?) can be used to improve market operation. Currently, this type of distributional information can be derived only with great difficulty by collecting panels of option price data at different strike prices for a given financial product, using the methods originated in 1978 by the economists Litzenberger and Breeden and other similar methods known to someone of skill in the art. Investors and others must then perform difficult calculations on these data to extract underlying distributions. In preferred embodiments of the present invention, such distributions are directly available.

Detail Description Paragraph:
[0969] Another advantage of systems and methods of the present invention for investing in groups of DBAR contingent claims is the provision, in preferred embodiments, of a returns adjustment mechanism ("price discovery"). In traditional

capital markets, a trader who takes a large position in relation to overall liquidity often creates the risk to the market that price discovery will break down in the event of a shock or liquidity crisis. For example, during the fall of 1998, Long Term Capital Management (LTCM) was unable to liquidate its inordinately large positions in response to an external shock to the credit market, i.e., the pending default of Russia on some of its debt obligations. This risk to the system was externalized to not only the creditors of LTCM, but also to others in the credit markets for whom liquid markets disappeared. By contrast, in a preferred embodiment of a group of DBAR contingent claims according to the present invention, LTCM's own trades in a group of DBAR contingent claims would have lowered the returns to the states invested in dramatically, thereby reducing the incentive to make further large, and possibly destabilizing, investments in those same states. Furthermore, an exchange for a group of DBAR contingent claims according to the present invention could still have operated, albeit at frequently adjusted returns, even during the most acute phases of the 1998 Russian bond crisis. For example, had a market in a DBAR range derivative existed which elicited trader expectations on the distribution of spreads between high-grade United States Treasury securities and lower-grade debt instruments, LTCM could have "hedged" its own speculative positions in the lower-grade instruments by making investment in the DBAR range derivatives in which it would profit as credit spreads widened. Of course, its positions by necessity would have been sizable thereby driving the returns on its position dramatically lower (i.e., effectively liquidating its existing position at less favorable prices). Nevertheless, an exchange according to preferred embodiments of the present invention could have provided increased liquidity compared to that of the traditional markets.

Detail Description Paragraph:
[0978] Traditional markets customarily have "no-arbitrage" relationships such as put-call parity for options and interest-rate parity for interest rates and currencies. These relationships typically must (and do) hold to prevent risk-less arbitrage and to provide consistency checks or benchmarks for no-arbitrage pricing. In preferred embodiments of systems and methods of the present invention for trading or investing in groups of DBAR contingent claims, in addition to such "no-arbitrage" relationships, the sum of the implied probabilities over the distribution of defined states is known to all traders to equal unity. Using the notation developed above, the following relations hold for a group of DBAR contingent claims using a canonical DRF: 72 r i = (1 - f) * i T i T i - 1 q i = 1 - f r i + 1 = T i i T i i q i = 1

Detail Description Paragraph:
[0987] In preferred embodiments of the systems and methods of the present invention for investing and trading in groups of DBAR contingent claims, traders may generate their own desired distributions of payouts, i.e., payouts can be customized very readily by varying amounts invested across the distribution of defined states. This is significant since groups of DBAR contingent claims can be used to readily replicate payout distributions with which traders are familiar from the traditional markets, such as long stock positions, long and short futures positions, long options straddle positions, etc. Importantly, as discussed above, in preferred embodiments of the present invention, the payout distributions corresponding to such positions can be effectively replicated with minimal expense and difficulty by having a DBAR contingent claim exchange perform multi-state allocations. For example, as discussed in detail in Section 6 and with reference to FIGS. 11-18, in preferred embodiments of the system and methods of the present invention, payout distributions of investments in DBAR contingent claims can be comparable to the payout distributions expected by traders for purchases and sales of digital put and call options in conventional derivatives markets. While the payout distributions may be comparable, the systems and methods of the present invention, unlike conventional markets, do not require the presence of sellers of the options or the matching of buy and sell orders.

Detail Description Paragraph:
[1014] The present invention has been described above in the context of trading derivative securities, specifically the implementation of an electronic derivatives exchange which facilitates the efficient trading of (i) financial-related contingent claims such as stocks, bonds, and derivatives thereon, (ii) non-financial related contingent claims such as energy, commodity, and weather derivatives, and (iii) traditional insurance and reinsurance contracts such as market loss warranties for property-casualty catastrophe risk. The present invention has also been described above in the context of a DBAR digital options exchange. The present invention is not limited to these contexts, however, and can be readily adapted to any contingent claim relating to events which are currently uninsurable or unhedgable, such as corporate earnings announcements, future semiconductor demand, and changes in technology. These and all other such modifications are intended to fall within the scope of the present invention.

Detail Description Table CWU:
1TABLE 1 Illustrative Visual Basic Computer Code for Solving CDRF 2 Function allocatetrades(A_mat, P_mat) As Variant Dim A_final Dim trades As Long Dim states As Long trades = P_mat.Rows.Count states = P_mat.Columns.Count ReDim A_final(1 To trades, 1 To states) ReDim statedem(1 To states) Dim i As Long Dim totaldemand As Double Dim total desired As Double Dim iterations As Long iterations = 10 For i = 1 To trades .sub. Forj = 1 To states .sub. statdem(j) = A_mat(i, j) + statedem (j) .sub. A_final(1, j) = A_mat(i, j) .sub. Next j Next i For i = 1 To states .sub. tolaldemand = totaldemand + statedem(i) Next i For i = 1 To iterations .sub. For j = 1 To trades .sub. For z = 1 To states .sub. IfA_mat(j, z) = 0 Then .sub. totaldemand = totaldemand - A_final(j, z) .sub. statedem(z) = statedem(z) - A_final (j, z) .sub. tempalloc = A_final(j, z) .sub. A_final(j, z) = stateall(totaldemand, P_mat(j, z), statedem(z)) .sub. totaldemand = A_final(j, z) + totaldemand .sub. statedem(z) = A_final(j, z) + statedem(z) .sub. End If .sub. Next z .sub. Next j Next i allocatetrades = A_final End Function Function stateall(totdemex, despaystate, totstateex) .sub. Dim soll As Double .sub. soll = (-(totdemex - despaystate) + ((totdemex - despaystate) {circumflex over ( )} 2 + 4 * despaystate * totstateex) {circumflex over ( )}0.5) / 2 .sub. stateall soll End Function

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